This is a brief and concise guide to those who are interested in installing the new generation of LT crate engines offered by GM Performance. A lot has changed in the last 3 years since I started so much of what I’ve already written may be out of date, but I still add updates whenever possible. This guide is also useful for take-outs or engine swaps from donor vehicles from wrecking yards.

**Engine mounting plates**

The LT block shares little with the previous generation of LS engines and requires a unique set of engine mounting plates. I used a pair of sliding engine mounts from Dirty Dingo called LT adjustable conversion mounts. They list for $154.95.

They also make a single mounting bracket with four adjustable holes that runs $69.95.

ICT Billet also makes an LT engine swap bracket that retails for $64.95.
Both systems use conventional small black Chevy Gen 1 engine mounting pads that will adapt to existing engine mounting locations in classic cars such as Chevelles, Novas and Camaros. The stock engine cradle may be a problem with a stock pan, especially if you want to mount a low driver’s side alternator.

Art Morrison has just released their LT motor mounting plates – Poly is $285 and rubber is $240.
These plates will not work with low mount AC compressors, or factory truck LT vacuum pumps. GM Part number 1154665 will be required to block the oil passages for the vacuum pump. If your engine came equipped with one from the factory, two of these are required to block the passages. $60.00 for the plates on the left and $80 for the adjustable weld on type. [www.lsxinnovations.com](http://www.lsxinnovations.com)

**Engine Pan**

Since both engines are available in dry sump or wet sump you must anticipate and design where your oil reservoir will be if you’re going with the dry sump version. I went with the wet sump version and had to modify my sump by cutting 1” off the front of the sump, but Moroso just came out with a new pan that should solve most of the subframe issues.

**Moroso part # 20155**

Holley just released their new LT1/4 pan under [part number 301-20](http://www.lsxinnovations.com).

GM’s new Gen V LT direct injected engines are starting to find their way into a large variety of vehicles. They make great power, plus they’re very durable and reliable. Unfortunately, the factory oil pans don’t always fit or they hang too low for today’s hot rods. Holley’s new LT Retro-fit Engine Oil Pan is designed to help! It provides maximum clearance to the chassis and ground, plus provides an OEM fitment for durability and
proper sealing. These oil pans are perfect for: 1967–’02 Camaro/Firebird, 1968–’74 Nova/Apollo/Ventura/Omega, 1978–’87 G-body, 1964–’72 A-body, and 1973–’87 Chevy/GMC Full Size Trucks

**Features:**

- Designed for LT Engine Retro-Fit Installations in Classic Car and Truck Chassis Requiring More Oil Pan to Chassis Clearance Around the Front Half of the Oil Pan
- Allows for up to 4.00″ Crankshaft Stroke
- Can Be Used Anywhere a GM F-Body Oil Pan Can Be Used
- Provides OEM fitment - Oil filter mounting, OEM Engine NVH Suppression, OEM Flange Sealing, Proper Structural Rigidity and OEM Bell-Housing Attachments.
- Traditional High-Quality Cast Aluminum Appearance With Clean Exterior Styling
- Provides Maximum Clearance for Vehicles Where the Steering Linkage is Behind the Engine cross-member
- Traditional high-quality cast aluminum appearance with clean exterior styling.
- Provides maximum clearance for vehicles where the steering linkage is behind the engine crossmember.
- Cast and machined aluminum
- Oil Cooler Port Provision
- 1/2″ NPT port – Ideal for Turbo Oil Return or PCV Oil Return
- Hinge Door Baffles Available
- Complete Kit Includes: Windage Tray, Sump Baffle, OE Style Pick-Up Tube, Sump Port Plug, Oil Filter Stud, Billet Oil Passage Cover, etc

The LT1 has a different oil cooler than the LT4 and it may or may not be an issue with mounting. The LT4 oil cooler is larger and hit the tubing that triangulated the Morrison front clip that I was using. I removed the sump and designed an air-cooled oil cooler rather than using the existing water cooled radiator design.

There have been numerous posts over the last year (2016) that identifies a cooling issue with LT4 engines that are used on the track and pushed hard (*GM has since added up to 13 intercoolers*). Once the oil temperature reaches 280 degrees the engine will shut down and run in **“limp mode.”** The 2017 Z06 and the ZL1 Camaro have improved cooling designs that will help with this problem. I remotely mounted a stacked plate cooler to the side and in front of the radiator on my ’68 Camaro. After running several “dyno tunes” we concluded that there was no IAT (Intake atmospheric temperature ) increase in temperature and the stacked plate cooler provided sufficient cooling for most applications. Another big advantage with going with a remotely mounted oil cooler
was the increase of 2 quarts of oil to the sump which now is 12 quarts instead of 10.

Hydraulic Power Steering

GM just announced a LT1 and LT4 Power Steering Kit P/N 19417241 (LT1) and P/N 19417242 (LT4) that is priced around $1,600 and is one way to achieve power steering on these engines.

The new L83/L84 and L86/87 truck engines are also available and make greats swap candidates. All American Billet has a very simple solution for their power steering conversion (PSBL83). They reference GEN V so they may work on LT1 applications. www.allamericanbillet.com
You now have an easy solution for adding a KRC PS3 power steering pump to your swap with this All American Billet bracket. Made from 6061-T6 aluminum and includes stainless steel mounting hardware $120.00. This takes the place of the stock vacuum assist pump on the L83/84.

All American Billet also produces a complete LT4 serpentine system that starts at $2095.00

(The following was written before the above products were available). This is a big problem since all the automobiles that are produced now use electric power steering, both engines have no provision for hydraulic power steering. I saw the 1970 GM SEMA Camaro and thought I could copy and use the system the factory used to plumb in a GM type II power steering pump into the serpentine belt system. This was not easy, took a considerable amount of time, but if you know how to engineer and fabricate it’s not that bad.
The hydraulic power steering pulley simply replaces the idler pulley that was there. It’s a standard GM type II pump that was sourced from Detroit Speed. I used a 2007 Dodge RAM power steering pulley that is slightly undersized from stock. The factory actually took a stock 6 rib pulley, split it apart and welded two halves together and then remachined it because GM does not manufacture an 8 rib pulley that will fit the Type II pump.

Eddie Motorsports does manufacture a power steering conversion for the LT1. [www.eddiemotorsports.com](http://www.eddiemotorsports.com)
The kit works in conjunction with the stock LT1 Front Engine Accessory Drive and comes complete with a GM Type II power steering pump, all necessary billet aluminum brackets and pulleys, stainless steel fasteners, and a belt. The kit requires the use of an ATI Racing #917314 (or equivalent) six rib damper (sold separately). MS107-19 with attached plastic P/S reservoir MS107-19B with attached billet aluminum P/S reservoir MS107-19R with P/S pump for remote reservoir MS100-18 ATI Racing Damper. Prices start at under $500.00

LT1 Gen V Air Conditioning Kit
The kit works in conjunction with the stock LT1 Front Engine Accessory Drive and gives you everything you need to install a compact Sanden SD7 air conditioning compressor for use with aftermarket air conditioning applications. The complete kit comes with a new compressor, all necessary billet aluminum brackets, compressor manifold, pulley cover, and stainless steel fasteners. MS107-98M Machined MS107-98P Polished MS107-98XX Specify Color

Dirty Dingo also manufactures a power steering pump conversion for the LT1 and they run $469.99

Drive Junky offers complete systems for all Gen V engines including L83/86, they start at $1,500
www.drivejunky.com
ICT Billet (ictbillet.com) offers a complete line of power steering, AC and high/low mount options starting at $150.
Headers
The stock header system on both the LT1/LT4 are a shorty type and most of the time will work.

For the best on the market look at Ultimate Headers.  www.ultimateheaders.com

These headers include the unique features of all Ultimate Headers products – strong and stylish cast 316L grade Stainless Steel flanges, investment cast elbows for tight clearances – to deliver performance in a very compact package.  Plus, you get a complete package – headers, ARP 12-point Stainless Steel header bolts, a pair of matching Cometic HTS header and HTS Collector Gaskets (if applicable).

Other options are Holley Blackheart Shorty SS or Longtube headers. 70101325-RHKR or 70301304-RHKR

For an inexpensive solution try Speed Engineering on Ebay, they offer both short & full length. Also sold by ICT Billet.
Wiring and controller system

If you haven’t rewired a classic car for an LS or the LT series of engines, things have changed considerably since the 50’s and 60’s. The controller system that comes with these engines includes a complete fuse panel and ECM that controls every function of the engine. In the LS series of engines the ECM is relatively easy to mount because it’s not that large, but in the LT engines it’s large, about the size of an iPad.

My biggest issue was trying to find a place for it because it simply didn’t fit anywhere. GM buries these ECMs deep within the modern cars and it’s a challenge just to find where they put them. I chose to mount it as shown and modified my heater box, but I wouldn’t recommend it. Instead I should have installed a Vintage Air System and completely removed the existing heater system because then you end up with a simple cover plate that goes over where the old heater box used to be. It’s much cleaner and a simpler way to go, plus it gives you plenty of room to install this massive ECM (see picture to the right).

The fuse box is just like the LS3 and includes all the fuses and relays to run the engine and additional electrical demand, plus it controls the fuel pump and the dual fan relays. You only need to hook up one wire (ignition - pink) to your existing system to get things going.

Donor or take-outs from wrecking yards
Just like the LS engines you will need to delete the VATS (Vehicle Anti-Theft) and remove the second O2 sensor information for emissions. This is relatively easy if you have HP Tuners or EFI Live. Some Dyno shops can
perform this, but if you don’t have anyone local consider standalone systems from either Speartech –
www.speartech.com or Howell EFI www.howellefi.com

I’ve also used Wayne Hartwig of 150tunes.com. They specialize in stripping out existing harnesses, removing
the VATS and emissions and sending you back a ready to go harness with a compact fuse panel. They also
build complete harness starting from $600.00


As for the body wiring harness, I suggest you dispense with whatever is there and use American Autowire or
Speedway 22 (speedwaymotors.com). They are simply the best in terms of schematics and offer anything
from the Route 9 to the Power Plus 20.
If you’ve got more than a simple street rod with power windows, 1500 watt amp or power seats, you’ll need something more than the Route 9. They also offer complete restoration harnesses for cars like 1956 Chevys, but they won’t work using the LT engines because the wiring theory is completely different than what was done 50 years ago. Do not try to adapt one of these original harnesses to the LT engine. We don’t use generators or ammeters anymore and we produce substantially more wattage than the older systems can handle. I’ve done it both ways and in the end it’s much better to remove what’s there and start from scratch.

VSS – Vehicle Speed Sensor

The VSS signal is required for these engines and cannot be omitted. If the engine does not see the VSS signal it will go into “limp mode” and provide 1/3 throttle. To wire in a digital speedometer use the Autometer schematic below. If you’re using the Dakota Digital VHX system, it uses a single wire VSS signal piggybacked off the signal from a manual transmission.

The 8L90E transmission is a second-generation model that uses an electronic controller built within the transmission itself. If you’re using the GM “Connect and Cruise” system it includes a separate controller that communicates back and forth between the engine ECU and the transmission itself. The new 8L90E transmission will only work on Gen V engines, it will not work on previous engines like the Gen IV LS. GM also has the same transmission in a 10 speed – 10L90e.
This system is part of the CANBUS or GMLAN electronic control system and is for all practical purposes standalone, they don’t want you piggybacking off the system because you can potentially disrupt the network transmission protocol. For the 8 speed automatic transmissions, the vehicle speed information is fed to the transmission controller through a pulse signal. The Vehicle Speed Sensor connector (on the wiring harness) is not used because there isn’t one on the 8L90E to plug into. The ECM is programmed and looking for 40 pulses per revolution. On the Connect N Cruise systems with the 8 speed automatic there are two wires in the wiring harness that are labeled Tach and Speedo, these wires appear to be CANBUS signals from the Bulkhead connector.

GM Powertrain recently brought to my attention that pin 14 (grey/blue wire) out of the transmission will provide a non-CANBUS raw signal (pulse generated) that should drive a conventional electronic speedometer. This is an inductive type signal, so voltage output is dependent on speed. Since I wrote the above paragraph I’ve had a builder tell me that they were unable to get the Dakota Digital Speedometer to read the VSS raw signal from the transmission. You may be able to get the Speedo to work if you use the SGI-5E expansion module.
Radiator

Since the LT4 develops 650 HP you need to make sure whatever radiator you’re using is up to handling the job, and that means dual fans. There are lots of high-end radiators such as Ron Davis and AutoRad, but I ended up using a US built radiator from Entrophy. This picture shows the LS/LT option with both inlet and outlet on the same side. For those of you who have been running Gen 1 and 2 engines, these modern engines run much hotter, the first fan kicks in at 207deg and the second at 221deg, do not attempt to modify these parameters. I’ve talked with many old hot-rodders who do not understand this and attempt to lower the temperatures because they feel uncomfortable with an engine running at those temperatures, this is foolish and will cause problems, not to mention lower the overall performance of the engine.
Gauges and Instrumentation

Modern engines use a CAN Bus (Controller Automotive Network) and GM’s version is known as GMLINK. To get your gauges to work I suggest you read Autometer’s installation guides for LS engines, first before you do anything. The easiest approach is to use Dakota Digital’s VHX gauge system with the BIM-01-2 OBD 2 interface. This reads the information from the OBD 2 diagnostic port and convert the signals into something that the VHX can understand.

The BIM-01-2 OBD-II (J1850/CAN) Interface allows you to plug directly into the engine diagnostic port, extracting engine and transmission data from the vehicle's computer (ECM). The BIM-01-2 will collect and output the following information to Dakota Digital Instrument Systems *:

Always available:

- Speed
- Tachometer
- Engine Temp
- Check Engine Indicator

Vehicle specific:

- Intake Air Temp
- Transmission Temp
- Ambient Air Temp
- Gear Position
- Oil Pressure

“Due to the various factory and modified ECM's, additional data including (Intake Temp, Transmission Temp, Ambient Air Temp, Oil Pressure, and Gear Position) may be available, but will vary from application to application. Dakota Digital cannot guarantee the presence or accuracy of the Intake Temp, Transmission Temp, Ambient Air Temp, Oil Pressure, or Gear Position displays since this is a function of the ECM and
matching OEM functional sensors.”

For LS and LT engines which have a 2 wire oil pressure GMLAN reference sensor the VHX system may not read this signal through the ODB connection. As shown above the LT4 already has an extra oil pressure sensor located right above the oil filter. You can install Dakota Digital’s 03-8 sender which is included in their gauge package with a 12mm x 1.5 adapter to read the oil pressure. To read the signal only requires changing the signal from BUS to Sender in the setup procedure.

Also, there are no blank plugs that are available to install a water temperature sender. Your options are limited here unless you want to install it in the water pump outlet (drill a hole), the radiator hose or the radiator itself. Gen V engines have a built in CANBUS signal for the water temperature, so you can use the

native signal directly to power the water temperature gauge in the Dakota Digital gauge set.

I completely redesigned the oil cooling system, removed the oil cooler from the side of the pan and installed conventional oil coolers at the front of the radiator. I installed a conventional sender (DD 04-5) at the end of the water pump. This was my solution, but it may not be something you want to attempt. The existing water temperature sensor is shown on the top of the water pump, but you cannot share this connection because it’s part of the CAN bus and won’t give you a signal that you can use unless you install the Dakota Digital VHX with BIM-01-2.

As far as which signals are available and which ones aren’t, it’s an ongoing issue. Both GM and Dakota Digital are continually updating their products and much of what I’ve experienced may be a thing of the past.

Fuel Pump

GM recommends a Pulse Width Modulated returnless system.

This control system is a stand alone, fully-integrated kit designed to run Chevrolet Performance LT4 series crate engines with 58x crankshaft reluctor wheels, 4x camshaft indexing, and electronic throttle control (ETC). This engine control kit is designed to operate a ‘GEN 5’ V8 only, it is not designed to operate any earlier engine configurations. Included in the kit are the engine control module (flushed with the appropriate calibration), fuel pump power module, engine harness, accelerator pedal, mass air flow (MAF) sensor, MAF sensor mounting boss, fuel line pressure sensor, oxygen sensors (2), and oxygen sensor mounting bosses (2). This control system is intended for use with a returnless fuel system and fuel pump that is capable of being pulse width modulated (PWM) at 25 kHz to control fuel pressure. A fuel flow rate of 65.6 G/H at 58 psi (400) kPa is needed. Because this is a dead headed system, a pressure relief set at 84 psi (580 KPa) must be included in the fuel line between the tank pump and the engine mounted high pressure pump.

Chevrolet Performance Part Number 19303293 is one example of a compatible fuel pump and it includes an internal pressure relief system. If using this pump, the lower port on the module may be left open or used to connect a remote pick up system. P/N 13587174 is connector pigtail for this pump and is available from your local dealer.

A pump with excessive capacity may result in cavitation at low flow due to the pump repeatedly stopping and starting instead of controlling to a speed/pressure. Alternatively, a fuel system operating at a fixed 500 KPa could be used and a fuel pump relay may be triggered by the Green/Gray wire in cavity 2 of the Fuel Pump Power Module (FPPM). Note that excessive fuel heating and potential startability/drivability issues may result from a constant high pressure.
The only vendor that I could find that would accept and use a conventional GM fuel pump 19303293 was Rick’s Tanks in Texas. They offer a weld-in adaptor plate, a bolt in adaptor and complete tanks.

They also offer specific fittings and the wiring adapter plugs for the fuel pump. They just released this new bolt in kit that will work on just about any existing tank. The main issue is having enough room in an existing tank that allows for all of the connections. This pictures shows all the wiring, fuel pressure sensor, the vent line and the fuel level sender.
GM has decided that they no longer want to recycle unused gas from conventional pumps, so they’ve come up with this new system to satisfy the demands of the new generation of Direct Injection Engines. Since the fuel pressures can be upwards of 2,500 psi, the FPPM (Fuel Pump Pressure Module) monitors the fuel pressure sensor (inline on the fuel hose) and communicates back and forth between the ECM and the fuel pump to deliver sufficient pressure. It’s also recommended that you “do not use a fuel line filter” anywhere along the system because the fuel pump itself has filters to take care of any issues. On a final note, there is no conventional fuel pump relay in the system. It appears that the fuel pump relay is electronic and housed within the FPPM module. As of this date GM has not addressed how the Fuel pump is fused. I suspect that it’s the 30 amp fuse in the PT (Powertrain) relay No. 2 in the fuse panel.

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